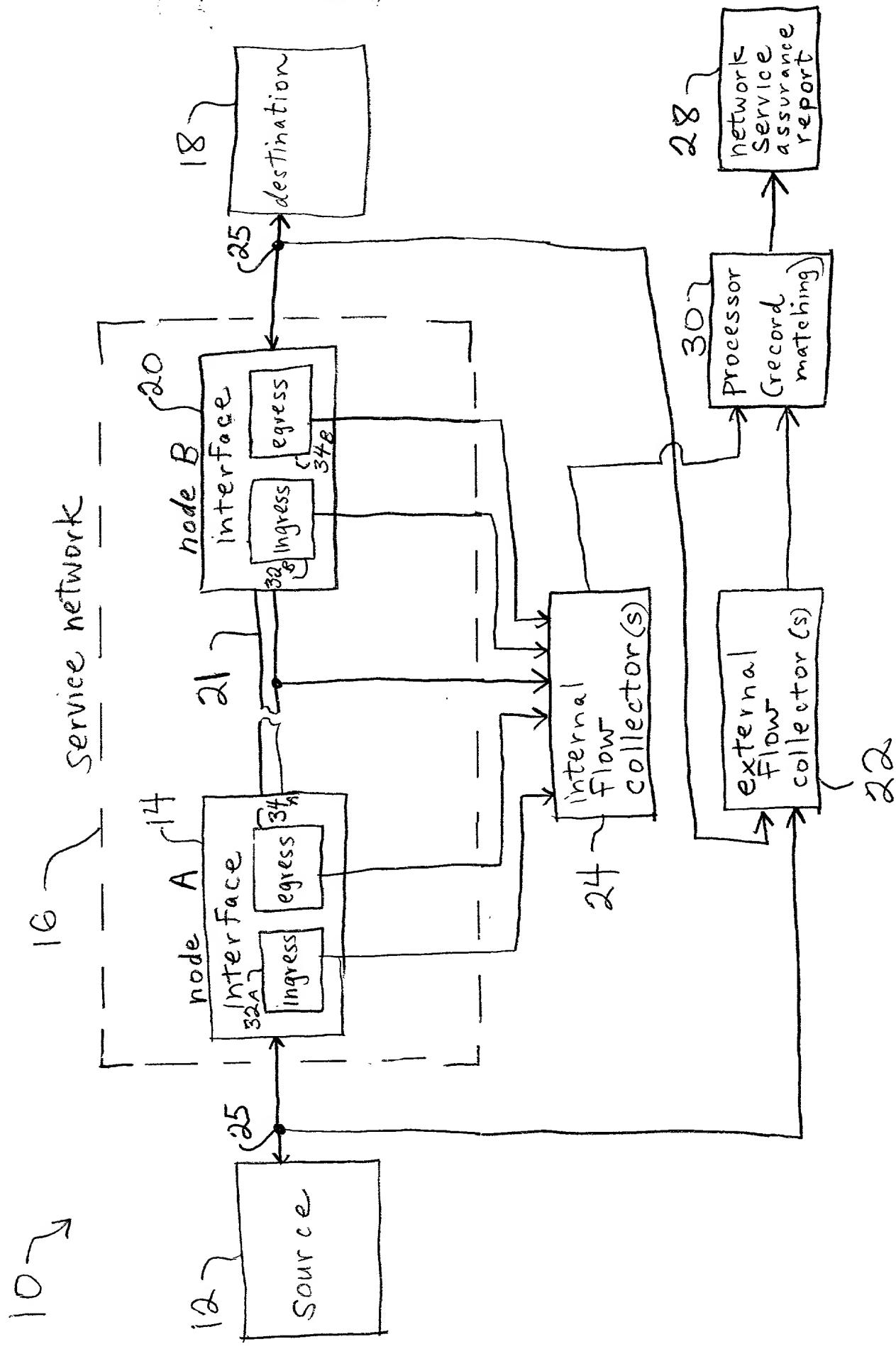


FIG. 1



26 \rightarrow time stamp data

Start time	end time or duration	Flow descriptor	Performance metrics
t_1		fd_1	pm_1
t_2		fd_2	pm_2
\vdots		\vdots	\vdots
t_n		fd_n	pm_n

FIG. 2
(prior ART)

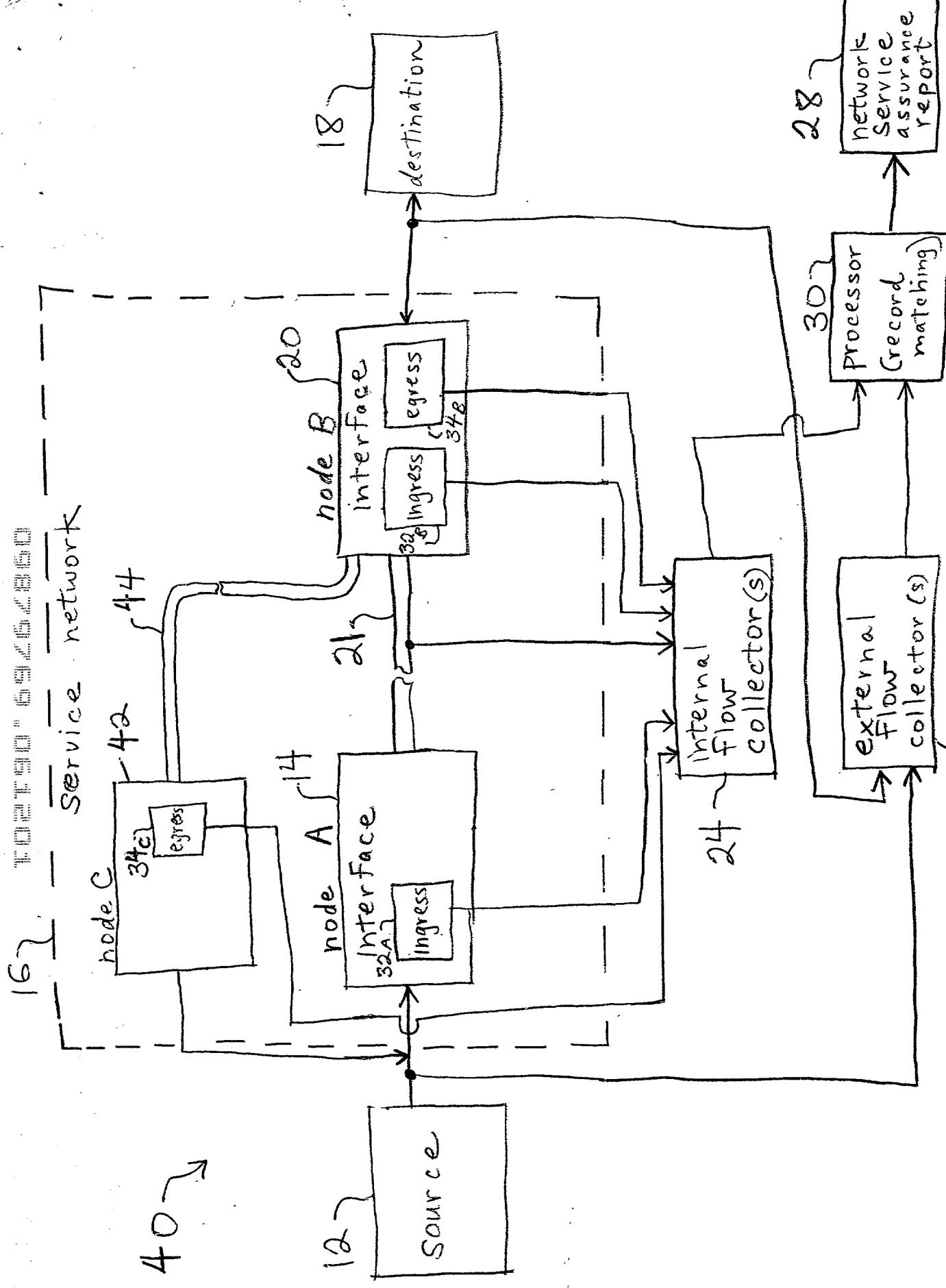


FIG. 3

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Example (all for fdi)	external flow collector (total packets)	internal flow collector (total packets)	external flow collector (total packets)	data analysis
	Source egress	Service network ingress	Service network egress	destination ingress
1	14	14	14	no loss
2	10	9	9	loss in service network
3	10	9	9	loss outside of service network
4	14	11	10	loss inside and outside of service network
5	10	5	10	loss outside of service network with alternate path into service network
6	10	5	10	loss outside of service network with alternate path around service network

FIG. 4

external flow collector (sequence number)	internal flow collector (sequence number)		service network Ingress Example 1	service network Ingress Example 2
Source egress	destination ingress			
10001	10001	10001	10001	10001
10002	10002		10002	
10003	10003	10003		
10004	10004			
10005	10005	10005	10005	10005
10006	10006	10006	10006	10006
10007	10007	10007	10007	
10008	10008	10008		
10009	10009	10009	10009	10009
10010	10010	10010	10010	10010
			round-robin load balancing	load balancing
			Diagnosis	

FIG. 5

Example	Source egress	Service network		destin. ingress	external flow collector	internal flow collector	external flow collector	Destination reachable?
		Ingress	egress					
1		fd_1		fd_1	fd_1	fd_1	fd_1	Yes
2		fd_1		fd_1	fd_1	fd_1	no fd_1	No
3		fd_1		fd_1	fd_1	fd_1	no fd_1	No
4		fd_1		fd_1	fd_1	fd_1	no fd_1	No
5		fd_1		fd_1	fd_1	fd_1	fd_1	Yes

FIG. 6

Example	external flow collector collector	internal flow collector	Connectivity?
Source		Service network	
1	$fd_1(i, e)$	$fd_1(i, e)$	Yes
2	$fd_1(\text{no } i, e)$	$fd_1(i, \text{no } e)$	No
3	$fd_1(\text{no } i, e)$	$fd_1(i, e)$	No

FIG. 7

FIG. 8A

Network Round-Trip Delay From Matched Flow Records

Specific Calculation	Description	Method
RTT ₁	Total Network Delay (dT ₁ + dT ₂ + dT ₃)	(Time Duration(FR _{E1}) – Time Duration(FR _{E2})
RTT ₂	Non Remote Network Delay (dT ₁ + dT ₂)	(Time Duration(FR _{E1}) – Time Duration(FR _{I2})
RTT ₃	Non Local Network Delay (dT ₂ + dT ₃)	(Time Duration(FR _{I1}) – Time Duration(FR _{E2})
RTT ₄	Local Network Delay (dT ₁)	(Time Duration(FR _{E1}) – Time Duration(FR _{I1})
RTT ₅	Service Network Delay (dT ₂)	(Time Duration(FR _{I1}) – Time Duration(FR _{I2})
RTT ₆	Remote Network Delay (dT ₃)	(Time Duration(FR _{I2}) – Time Duration(FR _{E2})

$$\text{TimeDuration}(FR_x) = FR_{\text{LastTime}}^* - FR_{\text{StartTime}}^{\dagger}$$

$$\text{TimeDuration}(FR_x) = FR_{\text{Duration}}$$

[†] Time represents the timestamp of the first packet transmitted from the source to the destination.

^{*} Time represents the timestamp of the last packet transmitted from the destination to the source.

FIG. 8B

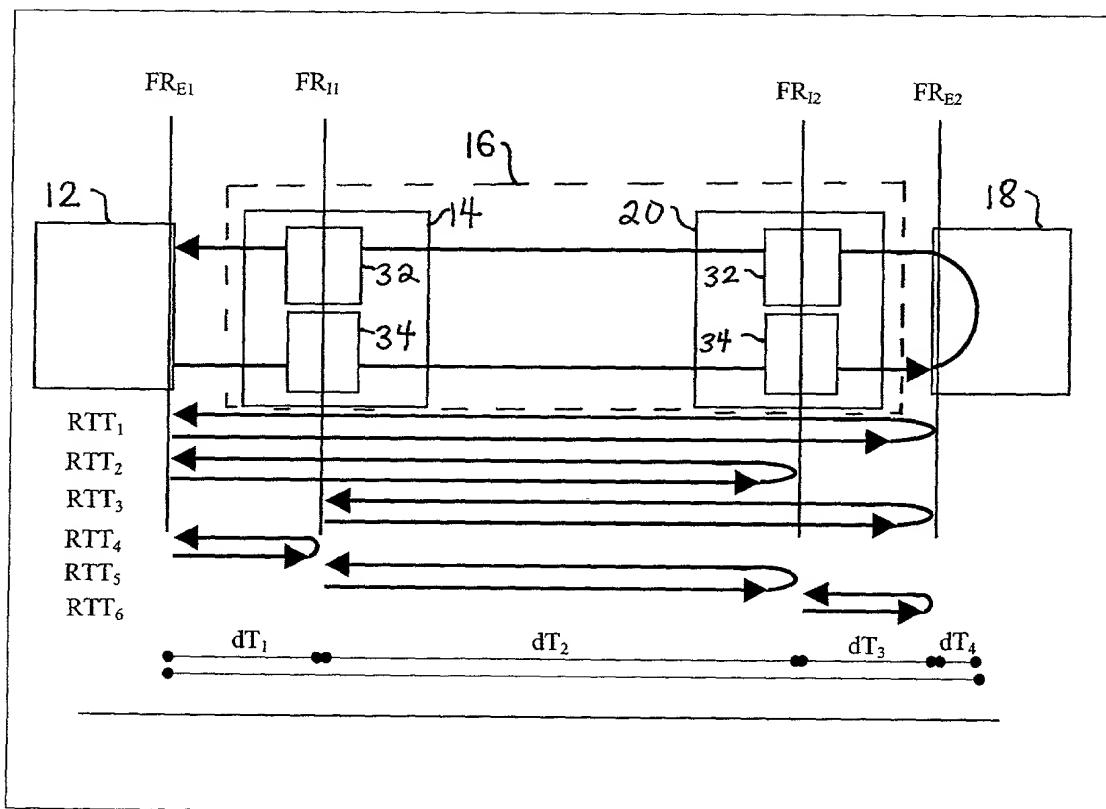


FIG. 9A

One-Way Delay Determination From Matched Flow Records

Specific Calculation	Description	Method
OWD ₁	Local Network Egress Delay	(StartTime(FR _{I1}) – StartTime(FR _{E1})
OWD ₂	Service Network Ingress Delay	(StartTime(FR _{I2}) – StartTime(FR _{I1})
OWD ₃	Remote Network Ingress Delay	(StartTime(FR _{E2}) – StartTime(FR _{I2})
OWD ₄	Remote Network Egress Delay	(LastTime(FR _{I2}) – LastTime(FR _{E2})
OWD ₅	Service Network Egress Delay	(LastTime(FR _{I1}) – LastTime(FR _{I2})
OWD ₆	Local Network Ingress Delay	(LastTime(FR _{E1}) – LastTime(FR _{I1})

$$\text{StartTime}(FR_x) = FR_{\text{StartTime}}^{\dagger}$$

$$\text{LastTime}(FR_x) = FR_{\text{LastTime}}^*$$

$$\text{LastTime}(FR_x) = FR_{\text{StartTime}}^{\dagger} + FR_{\text{Duration}}^*$$

[†] Time represents the timestamp of the first packet transmitted from the source to the destination.

* Time represents the timestamp of the last packet transmitted from the destination to the source.

FIG. 9B

